## REMARKS

Applicants have amended their claims in order to further clarify the definition of various aspects of the present invention. A "Status Of Claims And Support For Claim Changes" is set forth in a separate paper concurrently filed herewith, in light of 37 CFR 1.173(c). In summary, the subject matter of claim 2 has been incorporated into claim 1, with claim 2 being cancelled without prejudice or disclaimer. Noting, for example, claims 4, 15, 17, 18, 19 and 23, Applicants have also cancelled claims 3, 5-7, 11 and 12 without prejudice or disclaimer.

Furthermore, Applicants have added claims 29-31 to the application, further defining various aspects of the present invention including materials of the resin and inorganic filler, and further definition of the prepreg in terms of how such prepreg has been formed.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the documents applied by the Examiner in rejecting claims in the Office Action mailed June 15, 2005, that is, the teachings of the U.S. Patents to Ohta, et al., No. 5,641,997, to Babcock, et al., No. 5,340,644, to Leibfried, No. 5,451,637, to Beckley, et al., No. 5,552,466, and to Hashimoto, et al., No. 6,346,598, and European Patent Application No. 837090 to Takano, et al., under the provisions of 35 USC 102 and 35 USC 103.

Initially, it is noted that the subject matter of claim 2 has been incorporated into claim 1. That is, claim 1 now recites that the inorganic filler has previously been subjected to surface treatment by a silicone polymer. Moreover, note that claim 2 is not included in the claim rejections set forth in Items 2 and 4-6 on pages 2-4 of the Office Action mailed June 15, 2005, and that claim 2 has also not been included in

the rejection over the teachings of Hashimoto, et al. See the next-to-last paragraph on page 4 of the Office Action mailed June 15, 2005. Accordingly, it is respectfully submitted that each of the rejections set forth in Items 2 and 4-6 of the Office Action mailed June 15, 2005, as well as the rejection over Hashimoto, et al., set forth in the next-to-last paragraph on page 4 of the Office Action mailed June 15, 2005, is moot.

As for the rejections set forth in Items 7 and 8 on pages 5-8 of the Office Action mailed June 15, 2005, it is respectfully submitted that the documents as applied by the Examiner would have neither disclosed nor would have suggested such a prepreg, or such metal-clad-laminated board, or such printed wiring board, as in the present claims, including, inter alia, wherein the resin composition which has been impregnated into a substrate contains, among other components, an inorganic filler in an amount of 25% by volume or more based on the total volume of solid component of the resin composition and a silicone polymer, with the inorganic filler having previously been subjected to surface treatment by a silicone polymer. See claim 1.

In addition, it is respectfully submitted that the applied documents would have neither disclosed nor would have suggested such prepreg or other structures as in the present claims, referred to previously, having the inorganic filler volume and wherein such filler has previously been subjected to surface treatment, as discussed previously, and, additionally (but not limited to), wherein at least one metal foil is laminated on both surfaces or one surface of the prepreg of claim 1 or a laminated board thereof under heating and pressure (see claims 4 and 27); and/or the further definition of the silicone polymer as in claims 8-10 and 19-22; and/or the surface hardness of the metal-clad-laminated board as in claim 23; and/or wherein the resin composition further contains a coupling agent, as in claim 15 (see also claim 16);

and/or further definition of the resin composition as in claims 17 and 18; and/or further definition of amount of inorganic filler, as in claim 26; and/or materials of the resin and of the inorganic filler as in claims 29 and 30, respectively; and/or wherein the prepreg has been formed utilizing a varnish impregnated into the substrate, the varnish having a solid content within a range of 50-80% by weight (see claim 31).

The present invention is directed to a prepreg, and a metal-clad-laminated board and printed wiring board utilizing such prepreg. In particular, the present invention is directed to such prepreg including a resin composition containing a resin and an inorganic filler, which resin composition has been impregnated into a substrate of the prepreg, and a metal-clad-laminated board and printed wiring board formed using such prepreg.

Recently, in various electronic devices, printed wiring boards have been reduced in size and have had a high density. A form of practically mounting a printed wiring board on an electronic part has progressed from a conventional pin insertion type to a surface mounting type, and, in recent years, to an area array type such as a ball grid array. In these recent array types, it is general to carry out bonding between the chip and a substrate by thermal pressure wiring bonding; in such bonding, a substrate to which a bare chip is mounted is exposed to a high temperature of at least 150°C, so that it is required that the substrate have a relatively high surface hardness at the time (and temperature) of bonding. In addition, in order to effect a large number of wire bonds at a high speed, it is also required that the substrate have excellent surface smoothness.

As a technique of improving surface hardness at high temperatures, it has been proposed to increase a glass transition temperature of a resin utilized in the printed wiring board, e.g., by increasing cross-linking density. However, there is a

limit in the method of raising the glass transition temperature by increasing cross-linking density, and a problem still remains of providing sufficient surface hardness at the temperature of bonding, while providing a board having reduced surface roughness. In this regard, note the last full paragraph in the left-hand column on the first page of Applicants' specification.

While it has been proposed to change woven fabric to be used in a substrate of a metal-clad laminated board, for simultaneously improving surface hardness and surface smoothness, it is difficult to improve both surface hardness and surface smoothness to desired levels.

It is has also been proposed to include inorganic filler in the resin composition, for improving surface hardness and surface smoothness. However, this requires a relatively large amount of inorganic filler; and where the amount of inorganic filler is increased, aggregation of the inorganic filler itself and an increase in viscosity of the resin composition occurs, causing various problems including micro voids to occur.

Against this background, Applicants provide a structure having both high surface hardness at high temperature, and small surface roughness. Applicants have found that by including an inorganic filler in an amount of 25% by volume or more, in the resin composition utilized to impregnate the substrate in providing the prepreg, the high surface hardness at high temperature and small surface roughness are achieved; and, moreover, through use of the pretreatment of the inorganic filler with the silicone polymer, the resin composition can easily be impregnated into the substrate in forming the prepreg.

To emphasize, to maintain high surface hardness at a high temperature region of the glass transition temperature or higher, and to make the surface roughness small at the same time, Applicants have found that it is indispensable to

add an inorganic filler in an amount of at least 25% by volume. If the amount of inorganic filler is less than 25% by volume, sufficient surface hardness and sufficiently reduced surface roughness cannot be accomplished.

As to the unexpected advantages achieved according to the present invention, attention is respectfully directed to the enclosed (unsigned) Declaration. A signed copy of the Declaration will be submitted shortly. As can be seen therein, the Declaration includes Experiment I on pages 2-6 and Experiment II on pages 6-8.

In connection with Experiment I, note that to increase surface hardness, it is important that a modulus of elasticity of the substrate is high; and, as shown in Fig. 1 on page 3, the modulus of elasticity is abruptly increased at a neighborhood of 25% by volume. As stated in the Declaration, by formulating the filler in an amount of at least 25% by volume, surface hardness of the substrate is increased, and wire bonding properties are good.

Further in connection with Experiment I, attention is respectfully directed to Fig. 2 on page 3 of the enclosed Declaration. As seen in Fig. 2, by formulating the inorganic filler in an amount of at least 25% by volume, marked lowering in thermal expansion can be observed. Due to this lowering in thermal expansion, differences in thermal expansion of various materials of the printed wiring board are reduced, so that cracks can be reduced.

Attention is also respectfully directed to Experiment II and especially the Table in connection therewith on page 7 of the enclosed Declaration. As seen in this Table, by increasing amount of filler to at least 25% by volume, surface roughness is relatively small, and the Barcol hardness at 200°C is relatively large, providing excellent wiring bonding properties.

It is respectfully submitted that the enclosed Declaration establishes unexpectedly better results achieved according to the present invention, in both surface smoothness and surface hardness of, e.g., printed wiring boards formed using resin compositions containing at least 25% by volume inorganic filler, establishing unobviousness of the present invention.

Babcock, et al. discloses organosilicon compositions based on (a) hydrocarbon residues derived from polycyclic polyenes and (b) residues derived from cyclic polysiloxanes or tetrahedral siloxysilanes. The compositions include (A) alternating (a) cyclic polysiloxane or tetrahedral siloxysilane residues and (b) polycyclic hydrocarbon residues derived from polycyclic polyenes having at least two non-aromatic, non-conjugated carbon-carbon double bonds in their rings linked through carbon to silicon bonds, wherein at least one of the cyclic polysiloxanes or tetrahedral siloxysilanes (a) or the polycyclic polyenes (b) used to form the polymer or prepolymer has more than two reactive sites; (B) up to 85%, by weight, filler; and (C) at least one reaction rate modifier collected from the group consisting of alkyl diamines, alkyl triamines, alkyl tetraamines and alkyl pentaamines. See column 1, lines 45-60. See also column 6, lines 1-21, describing additives, such as fillers and pigment, which are readily incorporated in the compositions. This patent goes on to disclose that the polymers and prepolymers are well-suited for electronic applications, e.g., composites, adhesives, encapsulants, potting compounds and coatings. See column 7, lines 21-27.

Initially, note that Babcock, et al. discloses that the polymer or prepolymer includes up to 85% by weight of filler; and, for example, in column 6, lines 16-21, discloses amounts of filler in percent by weight. No lower limit is set. It is respectfully submitted that this reference does not disclose, nor would have

suggested, an amount of inorganic filler of at least 25% by volume, as in the present claims; and, in particular, would have neither disclosed nor would have suggested the unexpectedly better results achieved in utilizing an inorganic filler in an amount of at least 25% by volume.

In addition, note that Babcock, et al. does not disclose, nor would have suggested, the pretreatment of the inorganic filler, as in the present claims.

It is respectfully submitted that the additional teachings of Takano, et al. would not have rectified the deficiencies of Babcock, et al. such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art. Takano, et al. discloses printed wiring boards improved in drilling processability and insulation properties, and to production of prepregs and resin varnishes useful for the production of such printed wiring boards. In one embodiment described at page 4, lines 20-30, this patent document discloses that the resin composition includes a resin material and an inorganic filler treated with a silicone oligomer which contains at least one kind of siloxane units selected from specified trifunctional and tetrafunctional siloxane units, the oligomer having a polymerization degree of 2-70 and having at least one functional end group reactive to a hydroxyl group. This patent document also discloses on pages 9 and 10 that the resin composition also includes an inorganic filler, which has been pretreated with the silicone oligomer; and that in the resin composition the ratio of the treated inorganic filler to the resin material is generally such that the treated inorganic filler is 1.0-500 parts by weight, preferably 10-100 parts by weight, per 100 parts by weight of the resins in the resin material.

Even assuming, arguendo, that the teachings of Babcock, et al. and Takano, et al. were properly combinable, it is respectfully submitted that such combined

teachings would have neither disclosed nor would have suggested the presently claimed invention, including the amount (by volume) of inorganic filler in the prepreg, which inorganic filler has previously been subjected to surface treatment by the silicone polymer, and advantages thereof, in particular advantages in surface hardness at high temperatures and reduced surface roughness.

Leibfried discloses crosslinkable and crosslinked polymer compositions and processes for preparing these compositions, as well as silica-filled transfer molding compounds used for packaging electronic components including the crosslinked compositions. The crosslinkable or crosslinked compositions include a crosslinkable organosilicon prepolymer and an unsaturated elastomeric polymer, the organosilicon prepolymer having at least two hydrosilation reactive groups, and the polymer having at least two hydrosilation reactive unsaturated carbon-carbon bonds. Further, at least one of the silicon compound ant the polymer has more than two hydrosilation reactive sites. Note especially the paragraph bridging columns 1 and 2 of this patent. This patent goes on to describe that the structures disclosed therein include the crosslinked compositions in a form of coated or encapsulated electronic components, and prepregs and laminates for printed wiring boards. See column 2, lines 26-31. Note also column 3, lines 24-26 and 37-39. In column 15 of this patent, it is disclosed that additives such as fillers and pigments are readily incorporated in the composition, with various additives being disclosed. This patent goes on to disclose that fillers can be present in amounts up to about 15% by weight of the crosslinkable compositions of the invention, and in even higher amounts, i.e., up to about 95% by weight, when glass fibers are not used. See, especially, column 15, lines 25-30 and 35-43.

Takano, et al has been previously discussed.

Even assuming, arguendo, that the teachings of Leibfried and of Takano, et al. were properly combinable, such combined teachings would have neither disclosed nor would have suggested the presently claimed subject matter, including at least 25% by volume of inorganic filler, which inorganic filler has previously been subjected to surface treatment by a silicone polymer, and unexpectedly better results achieved thereby in forming a printed wiring board having high surface hardness at high temperatures and small surface roughness.

In addition, it is respectfully submitted that the teachings of the applied references do not disclose, nor would have suggested, such prepreg or structure formed therefrom as in the present claims, having features as in claim 1 and discussed previously, and having other features as in the dependent claims, as referred to previously.

In Items 4 and 5 on pages 3 and 4 of the Office Action mailed June 15, 2005, the Examiner points to amounts of inorganic fillers added in each of Babcock, et al. and Leibfried. It must be emphasized, however, that these references include filler optionally; and, moreover, do not disclose a minimum amount thereof. It is respectfully submitted that these references do not disclose, nor would have suggested, the present invention, including the minimum amount of inorganic filler as in the present claims, and advantages achieved thereby.

In view of the foregoing comments and amendments, reconsideration and allowance of all claims presently in the application are respectfully requested.

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Applicants request any shortage of fees due in connection with the filing of this paper be charged to the Deposit Account of Antonelli, Terry, Stout & Kraus, LLP, Deposit Account No. 01-2135 (case 511.40488R01), and credit any excess payment of fees to such Deposit Account.

Respectfully submitted,

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Enclosure: Declaration Under 37 CFR 1.132 (8 pp., unsigned)

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